

**FINAL**  
**BLACKSTONE RIVER BASIN**  
**WORCESTER, MASSACHUSETTS**

**LEESVILLE POND DAM**  
**MA 00141**

**PHASE I INSPECTION REPORT**  
**NATIONAL DAM INSPECTION PROGRAM**

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**DEPARTMENT OF THE ARMY**  
**NEW ENGLAND DIVISION, CORPS OF ENGINEERS**  
**WALTHAM, MASS. 02154**

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NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS

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COES RESERVOIR DAM, IDENTITY NO. MA 00120  
✓ LEESVILLE POND <sup>DAM</sup> MA 00141  
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NO COMMENTS !!!

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Leesville Pond Dam is an earthfill dam with a stone masonry spillway section. The dam is about 220 feet long, 15 feet high with an 83.6 foot long spillway. The dam is considered to be in fair condition. However, there are several visible signs of distress which may indicate a potential hazard at this site. For this reason the dam has been classified in the "significant" hazard category.		

LEESVILLE POND DAM

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BLACKSTONE RIVER BASIN  
WORCESTER, MASSACHUSETTS

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION  
PROGRAM



NATIONAL DAM INSPECTION  
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00141

Name of Dam: Leesville Pond

Town: Worcester

County and State: Worcester County, Massachusetts

Stream: Kettle Brook - Tributary of Blackstone River

Date of Inspection: July 24, 1978

Leesville Pond Dam is an earthfill dam with a stone masonry spillway section. The dam was originally constructed in about 1830 and has undergone reconstruction and numerous modifications. The dam is about 220 feet long, 15 feet high with an 83.6-foot-long spillway. The earth embankment has a wood plank core wall. The outlet controls consists of two inoperable wooden slide gates. There are no flashboards on the spillway.

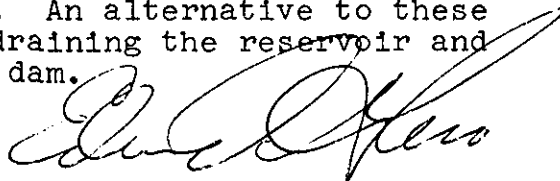
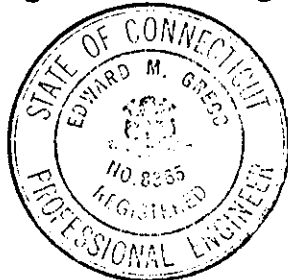
Due to its age, Leesville Pond Dam was neither designed nor constructed by current approved, state-of-the-art procedures. Based upon the visual inspection at the site and a review of the engineering data available, there are areas of concern which must be corrected to assure the continued performance of this dam. Generally, the dam is considered to be in fair condition. However, there are several visible signs of distress which may indicate a potential hazard at this site. These are as follows: seepage at the north spillway abutment, slumping and erosion on the upstream face of the dam, inoperable slide gates, leakage around the slide gates, erosion of the earthfill abutment slopes, minor spalling and cracking of the concrete in the discharge channel walls, trees and brush on the dam, and accumulation of debris in the spillway channel.

There is limited residential property immediately downstream of Leesville Pond Dam. For this reason, the dam has been classified in the "significant" hazard category, however, a failure of the dam could affect Curtis Pond Dam and in turn jeopardize the Webster Square area of Worcester.

Hydraulic analyses indicate that the existing spillway without flashboards can discharge a flow of 1,594 cubic feet per second (cfs) at Elevation (El) 488.3 which is the low area along the top of the dam. An outflow test flood of 8,600 cfs would overtop the north abutment of the spillway, which is the lowest point on the main dam, by about 5.3 feet. The remainder of the dam would be overtopped by about 3 feet. The spillway can discharge only 19 percent of the test flood and is therefore inadequate.

In the event the dam fails, a hazard does exist for the downstream inhabitants due to the effect upon Curtis Pond. Because of this potential hazard and the lack of available design and construction data, it is recommended that the Owner employ a qualified consultant to investigate the seepage and stability of the dam. In addition, the Owner should repair the slumping of the upstream face and replace the riprap. Also, it is recommended that the Owner remove the brush and trees on the dam, clear all debris from the spillway, and repair the outlet structure.

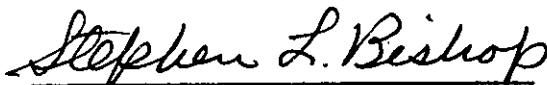
The recommendations and remedial measures described in Section 7 should be implemented by the Owner within a period of 1 year after receipt of this Phase I Inspection Report. An alternative to these recommendations would be draining the reservoir and breaching or removing the dam.



Edward M. Greco, P.E.  
Project Manager  
Metcalf & Eddy, Inc.

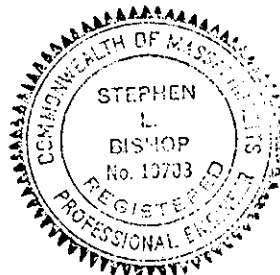
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Approved by:



Stephen L. Bishop, P.E.  
Vice President  
Metcalf & Eddy, Inc.

Massachusetts Registration  
No. 19703



This Phase I Inspection Report on Leesville Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman  
Chief, Foundation and Materials  
Branch  
Engineering Division

FRED J. RAVENS, Jr., Member  
Chief, Design Branch  
Engineering Division

SAUL C. COOPER, Member  
Chief, Water Control Branch  
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR  
Chief, Engineering Division

## PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detail investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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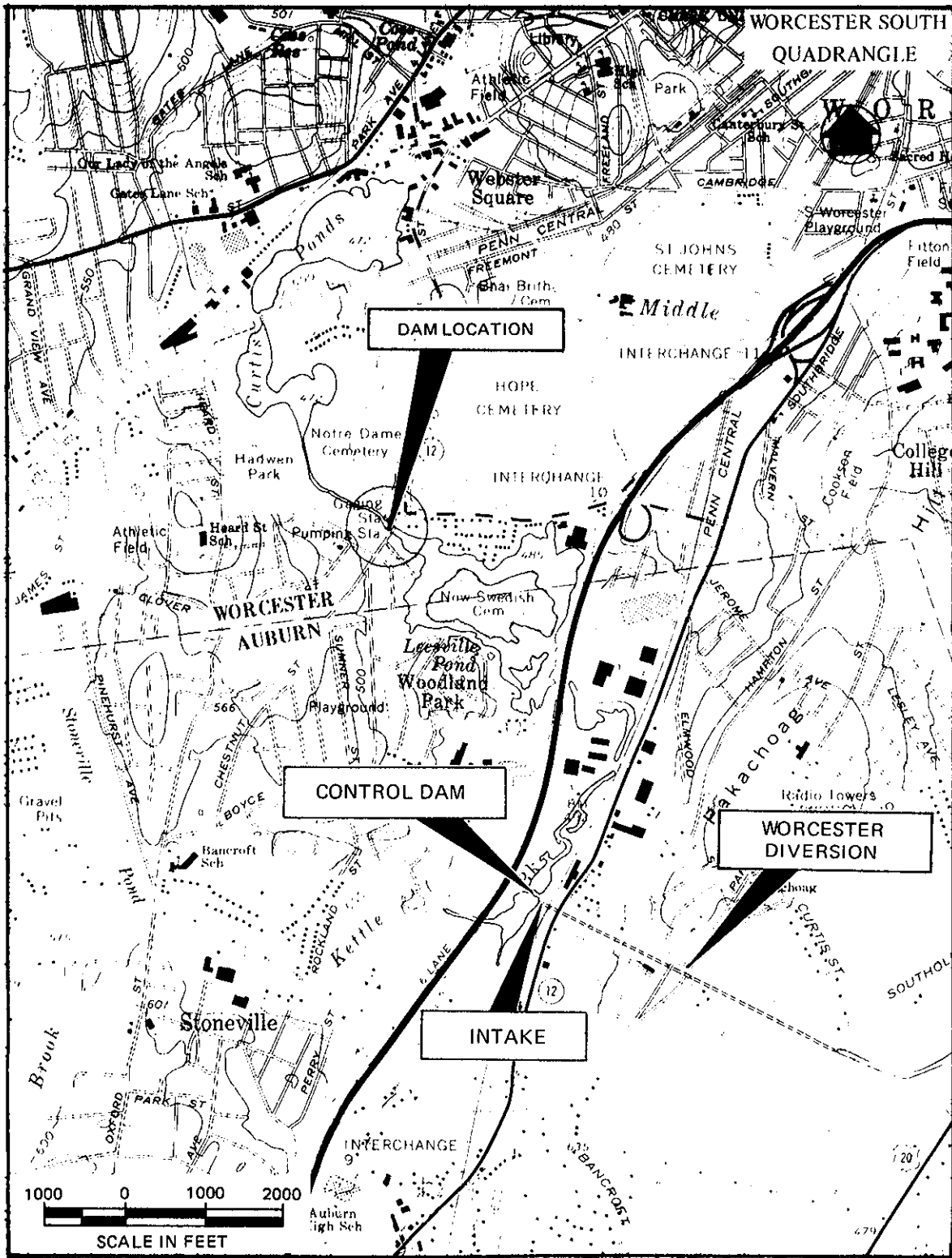


**OVERVIEW  
LEESVILLE POND  
WORCESTER, MASSACHUSETTS**



**VIEW FROM OXFORD STREET BRIDGE**

**Location and Direction of Photographs  
Shown on Figure in Appendix B**



LOCATION MAP - LEESVILLE POND DAM



NATIONAL DAM INSPECTION  
PROGRAM

PHASE I INSPECTION REPORT

LEESVILLE POND

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Metcalf & Eddy, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0306 has been assigned by the Corps of Engineers for this work.

b. Purposes

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
- (3) To update, verify and complete the National Inventory of Dams.

## 1.2 Description of Project

- a. Location. The dam is located in the City of Worcester, Worcester County, Massachusetts, on Kettle Brook, a tributary of the Blackstone River. Approximately 60 percent of Leesville Pond is in the Town of Auburn. (see Location Map, and Watershed Plan, Figure D-1).
- b. Description of Dam and Appurtenances. Leesville Pond Dam is an earthfill structure approximately 220-feet long and a maximum of 15 feet high (see Appendix B, Figures B-1, B-2, B-3 and B-4). The dam is comprised of a north and south earth embankment section on either side of a concrete and stone masonry spillway. The northern section, which is separated from the spillway by a gated concrete outlet channel, is approximately 60-feet long and 12-feet wide at the crest. The crest consists of a 2-foot wide and 1-foot high concrete cap wall adjacent to a 10-foot wide concrete apron. At the south embankment of the dam section the capwall is 52 feet long, and the concrete apron about 27 feet long. South of the concrete apron the crest of the dam is earth and covered with vegetation. A detailed plan of the dam is shown in Figure B-4, Appendix B.

The maximum elevation of the concrete capwall is 490.5. The concrete apron is at El 489.7. The upstream and downstream slopes of the dam vary from 1:1 to 3:1. The riprap on the south embankment has deteriorated on the upstream slope. A 2-foot-high vertical stone wall is located near the top of the downstream slope. The slopes of the north embankment are entirely overgrown by trees and vegetation.

The spillway is a flat, broad-crested weir constructed of dry-stone masonry and capped with concrete. The crest is 83.6 feet wide and at El 485. The south sidewall of the weir

is concrete, about 20 feet long and 1 foot thick. The north wall, which separates the spillway from the outlet channel, is a concrete-faced stone buttress 25 feet long and about 10-feet wide. Discharge is over the weir, down a cascade, and into a stream bed. As shown in the photograph in Appendix C, the downstream spillway section is comprised of a stepped stone section 55 feet wide, and a smooth-sloped concrete section 29 feet wide. A 4-foot diameter circular opening, possibly an abandoned outlet conduit, was noted through the sloped concrete section. The opening was probed and found to extend 17.5 feet back into the spillway. An intake to this conduit was not visible in the pond. Figure B-3 of Appendix B shows a "waste pipe" at this location.

There is a concrete intake structure located north of the spillway (see Figure B-3 for details). The flared approach channel is 11 feet wide at the gates with 1.3-feet thick concrete training walls that slope into the pond. The bed of the channel is at El 478.4. The intake structure, as shown on the 1936 drawing (Figure B-4), has two 5-foot square wooden slide gates separated by a 1-foot thick wall of concrete and covered by a concrete slab. Two rack and pinion mechanisms are on the upper slab but are not operable. The invert of the slide gates in the outlet channel is at El 476.9. The outlet channel is also 11 feet wide with concrete sidewalls and is cut in half by a 1-foot-thick sloping concrete wall that extends for 10 feet. The stone and concrete buttress on the south side of the outlet channel has a downstream slope of approximately 2:1. Access to the slide gate mechanism is by a footpath north of the crest of the dam along the shore.

- c. Size Classification. Leesville Pond Dam is classified in the "small" category since it has a maximum height of 15 feet and a maximum storage capacity of 415 acre-feet.

- d. Hazard Classification. Leesville Pond is approximately 2,000 feet upstream of Curtis Pond. The area between the two ponds is mostly cemetery property and parkland. In the event of failure of the dam at Leesville Pond, the effect on lives and property immediately downstream of the dam would be small. Accordingly, Leesville Pond Dam has been placed in the "significant" hazard category. However, the resulting flood wave could raise the level of Curtis Pond and could cause failure of the Curtis Pond Dam. Webster Square is immediately downstream from Curtis Pond. This is a highly urbanized area which could experience extensive property damage, and many casualties.
- e. Ownership. The dam was recently acquired by the J. P. Realty Company, 3 Hickory Lane, Auburn, Massachusetts. Mr. Alex Pappas (617-832-3718) granted permission to enter the property and inspect the dam.
- f. Operator. There are no known operators of the dam. The wooden slide gates appear to be inoperable due to rotted timber gate stems and missing parts on the gate mechanism.
- g. Purpose of the Dam. The dam was most recently used as a storage pond for fire protection by the Worcester Rendering Company, a subsidiary of Consolidated Rendering Co., 18 Southbridge Street, Auburn, Massachusetts. Water was pumped to a water tower on the Rendering Company property where it was stored for emergency use. The Rendering Company has since closed, and the pond is now principally used for recreation.
- h. Design and Construction History. A timber dam was originally built on Kettle Brook sometime prior to 1830. The dam and spillway have been entirely rebuilt since then. Beginning in 1928, construction reports by Worcester County inspectors describe the general condition and repairs needed at the dam.

Portions of the present spillway existed prior to 1928. Several modifications have been made to the dam since then. In 1928, the Worcester County Engineer's office ordered repairs, including reducing the height of the flashboards and reconstructing the timber walkway over the spillway. In addition the County recommended that concrete be placed on the south end of the stepped cascade to prevent collapse of the stonework.

The sloping concrete apron for the spillway was added sometime prior to 1931.

In 1936 plans were submitted to the Worcester County Engineer's office by Consolidated Rendering Company for the proposed installation of the waste gates (slide gates) at the north end of the spillway (see Figure B-3, Appendix B). The plan also shows the former timber crest of the weir, the flashboards, and the location of the waste pipe.

In 1937 the County noted seepage through the top of the concrete apron along the waste pipe and recommended the addition of a concrete core wall upstream of the wooden sheeting. The core wall was to extend into the south abutment and tie into the new gate structure on the north. It was recommended that the wooden weir be replaced with concrete and the waste pipe plugged. Also, the stone walls on the abutments should be raised 2 to 3 feet and an automatic tripping device installed on the flashboard pins.

The County records indicate that not all the aforementioned recommendations were implemented. Nevertheless, the dam was not severely damaged during the 1938 floods.

Alterations at the north abutment of the dam by the R. H. White Construction Company were in progress in 1954. The end product was to consist of building up the concrete walls of the sluiceway and adding a new 25-foot long

core wall constructed of 3-inch wood sheeting in a concrete footing, backfilled with an impervious clay core, and capped with concrete.

The wall was under construction when the 1955 floods overtopped the dam by about a foot and washed out both abutments. Modifications after the flood, as shown in Figure B-4, consisted of extending the core wall into each abutment to prevent future washouts. Also at this time the present concrete apron was added to the crest and extended upstream at the approach channel. New riprap was placed on the upstream slope of each abutment.

In 1958 the inspection report noted flooding in the abutting property and the flashboards were ordered lowered or removed. By 1969 the condition of the dam was rated as poor, because of leaks through the spillway, and rotting wood on the gates. A 1973 inspection report by the Massachusetts Department of Public Works (see Appendix B) calls for removal of trees and brush from the embankment and restoration of the downstream slope of the south (left) abutment.

1. Normal Operational Procedure. There are no known operating procedures at this dam. The wooden sections of the rack and pinion mechanism have rotted away, leaving the gates inoperable.

The main spillway is ungated and flows are unrestricted. The former "waste pipe" on the spillway is apparently plugged.

### 1.3 Pertinent Data

- a. Drainage Area. Leesville Pond has a drainage area of approximately 20,540 acres (32.1 square miles), with a large number of swamps and ponds. (see Figure D-1 in Appendix D for the relative location of the pond in the watershed). Kettle Brook drains from the north and west and includes five major reservoirs for public

water supply. The brook flows through rural, sparsely developed woodland until it reaches the municipal airport and the Worcester City limits, where there is more residential development. Dark Brook drains from Dark Brook Reservoir in the south to Stoneville Pond where it joins Kettle Brook. This area is also moderately developed. A third stream, Ramshorn Brook, flows through gently rolling, very sparsely developed woodland, north to Pondville Pond and downtown Auburn, and finally to Kettle Brook.

Prior to 1959, high water in the watershed would cause flooding in downtown Worcester in the area of Webster Square. In 1959, the U. S. Army Corps of Engineers completed a major diversion structure about one mile upstream of the dam on a southern extension of the pond (see Location Map). The structure, called the Worcester Diversion, consists of an earth control dam with the crest at El 498 and a concrete ogee spillway section with the top at El 492. Major stream flows as high as to 6,000 cfs are diverted by the spillway to a tunnel and a series of canals that flow east and eventually discharge into the Blackstone River, about 3,500 feet south of the Worcester City limits. The intake of the diversion tunnel is at El 487. Two slide gates on the spillway section discharge normal flows. At the time of the inspection one gate was partly opened. During peak storm periods, however, the gates are closed and all the water is diverted to the tunnel. Detailed information on the Worcester Diversion is provided in U.S. Army Corps of Engineers, Design Memorandum No. 1, Hydrologic Analysis, August 1956.

- b. Discharge at the Dam Site. Normal discharge at the dam is over the 83.6-foot-wide spillway, down the stepped and sloped sections of the cascade, and into the stream channel which is approximately 100 feet wide. The channel narrows to about 56 feet at the Webster Street

Bridge. The stream bed which is naturally lined with gravel and cobbles, is at El 475 and slopes to El 472 about 150 feet downstream. Water passes under the Webster Street Bridge through an opening which is 40 feet wide and 10 feet high from the streambed to the bottom of the lowest H beam on the bridge (see Figure B-2, Appendix B).

Downstream of the bridge is a USGS gaging station. Past this the stream flows over a small (about 3 feet high) concrete control dam built across the channel. This section of the stream channel is bounded by a stone wall on the north side and a concrete wall on the south. From there the water flows in a stream to Curtis Ponds.

Hydraulic analyses indicate that the spillway can discharge an estimated 1,594 cfs at El 488.3, which is the elevation of the north abutment of the spillway and the lowest point on the crest of the dam. An outflow test flood of 8,600 cfs (one-half the probable maximum flood minus the flow through the Worcester Diversion) will overtop the dam by a maximum of 5.3 feet. Records at the Worcester County Engineer's office state that the dam was overtopped by about 1 foot in 1955.

Controlled discharge was formerly through the slide gates. These are now closed and no longer operable.

- c. Elevation (feet above Mean Sea Level [MSL]). A benchmark at El 485.0 at the spillway crest was estimated from a U.S.G.S. topographic map.

- (1) Top dam: 488.3 to 490.5
- (2) Test flood pool: 493.6
- (3) Design surcharge (original design):  
Unknown
- (4) Full flood control pool: Not Applicable  
(N/A)



- (5) Recreation pool: 485.0
- (6) Spillway crest (ungated): 485.0
- (7) Upstream portal invert diversion tunnel (Worcester Diversion): 487.0 (upstream diversion spillway crest elevation: 492)
- (8) Stream bed at centerline of dam: 475.1
- (9) Maximum tailwater: 475.9

d. Reservoir

- (1) Length of maximum pool: 6,800 feet
- (2) Length of recreation pool: 6,800 feet
- (3) Length of flood control pool: N/A

e. Storage (acre-feet)

- (1) Test flood surcharge: 430 at El 493.6
- (2) Top of dam: 415
- (3) Flood control pool: N/A
- (4) Recreation pool: 250 (Approximate)
- (5) Spillway crest: 250

f. Reservoir Surface (acres)

- \*(1) Top dam: 50
- \*(2) Test flood pool: 50
- (3) Flood-control pool: N/A
- (4) Recreation pool: 50
- (5) Spillway crest: 50

\*Based on the assumption that the surface area will not significantly increase with changes in pond elevation from 485 to 488.3.

g. Dam

- (1) Type: Earthfill
- (2) Length: 220 feet
- (3) Height: 15 feet
- (4) Top width: 11 feet
- (5) Side slopes: 1:1 to 3:1
- (6) Zoning: Unknown
- (7) Impervious core: 3-inch wood plank cutoff, backfilled with clay on upstream and downstream sides
- (8) Cutoff: Unknown
- (9) Grout curtain: Unknown

i. Spillway

- (1) Type: Broad crest
- (2) Length of weir: 83.6 feet
- (3) Crest elevation: 485.0 MSL (assumed benchmark)
- (4) Gates: None
- (5) Upstream Channel: None
- (6) Downstream Channel: Stone cascade to 50-foot wide stream bed
- (7) General: Downstream bridge 150 feet from dam; 40 feet wide, 10-foot high passage for water

- j. Regulating Outlets. The only regulating outlets are the two 5- by 5-foot wooden slide gates at the intake structure. The rack and pinion mechanisms for opening the gates have deteriorated beyond use, and the outlet channel, which runs parallel to the spillway cascade, is clogged with debris.

## SECTION 2

### ENGINEERING DATA

- 2.1 General. The only plans, specifications, or computations available from the Owner or State or County offices relative to the design, construction, or repair of this dam are as follows: a 1936 Plan of Waste Gate Works across Leesville Pond, and a 1955 Plan of Reconstruction of Dam on Leesville Pond which shows details of the core wall and concrete apron. Copies are included in Appendix B. Supplementary information for the hydraulic-hydrologic evaluation for the dam was provided in U. S. Army Corps of Engineers "Design Memorandum No. 1", dated August 1956, for the Worcester Diversion. Three plans for this tunnel and the control dam were provided by the Corps, but were not included in this report. The only other data available for this evaluation were visual observations during inspection, review of previous inspection reports, and conversations with the Owner and with personnel from the State and County agencies.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Department of Public Works, Messrs. Willis Regan and Raymond Rochford, and of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways, Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office: Messrs. John O'Toole, Joseph Brazauskas, and Mr. Wallace Lindquist - recently retired from county service.

In addition, we thank Mr. Alex Pappas of the J.P. Realty Co., owners of the dam, who allowed us to inspect the dam and provided us with information on the history of the pond.

- 2.2 Construction Records. The only construction records are those listed in Section 2.1 and included in Appendix B. There are no as-built drawings for the dam.
- 2.3 Operation Records. No operation records are available, and there is no daily record kept of pool elevation or rainfall at the dam site. A USGS gaging station is located about 200 feet downstream from the dam, however.
- 2.4 Evaluation
- a. Availability. There is limited engineering data available due to the age of the dam.
  - b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.
  - c. Validity. Comparison of available drawings with the field survey conducted during the Phase I inspection indicates that the information is valid.

## SECTION 3

### VISUAL INSPECTION

#### 3.1 Findings

- a. General. The Phase I Inspection of the dam at Leesville Pond was performed on July 24, 1978. A copy of the inspection check list is included in Appendix A. Periodic inspections of this dam have been made by others since 1925. A partial listing of these inspections is in Appendix B. An inspection was made in 1973 by personnel from the Massachusetts Department of Public Works and a copy of their report is included in Appendix B also.
- b. Dam. Leesville Pond Dam is an earthfill dam with a wood plank core wall and a reinforced concrete capwall and apron. In general, the concrete is in good condition although there is slight spalling of the concrete at the joints in the capwall. The concrete apron and capwall tie into natural ground at the abutments. The abutment area is eroded on both the upstream and downstream slopes. On the upstream slope of the south embankment area, there is some random riprap protecting the face, however, slight slumping of the soil is visible. At the northern upstream face, a few riprap stones are visible. The upstream and downstream slopes of both embankments are overgrown with vegetation, including a number of 12- to 18-inch diameter trees on the upstream face of the south embankment.
- c. Appurtenant Structures. The concrete and stonework on the spillway are in fair to good condition. Holes for flashboard pins are still visible on the weir and there is minor spalling and erosion on the training walls. The concrete face south of the stepped section is in good condition. Seepage is evident at the toe of the north spillway abutment (see Figure B-1). A tree is growing at that location and the seepage appears to be following the roots.

The cascade and downstream channel contain minor amounts of debris especially at the toe of the concrete-faced cascade section.

The outlet structure is in poor condition. The intake to the gates is submerged and there is evidence of cracking along the joints on the training walls and erosion along the water line. The slide gates are presently inoperable and it is not known when they were last used. The rack and pinion mechanisms above the gates are rusted, and the wooden parts have rotted away. There is leakage along the top of both wooden gates. In general the concrete outlet channel is in fair condition with only minor spalling, but the floor of the channel is cluttered with wood and trash. One large and several smaller trees and brush have overgrown the outlet channel.

- d. Reservoir Area. The drainage area is comprised of both heavily populated urban and sparsely developed rural and wooded areas. The Worcester Diversion is located 1-1/4 miles upstream from the dam. Leesville Pond has been divided artificially by this flood control diversion, a culvert under Sword Street in Auburn, and the embankment for Highway I-290, which was added within the last 10 years.
- e. Downstream Channel. The discharge from the spillway flows for about 400 feet down a gravel and cobble streambed with concrete and stone sidewalls. Below 400 feet the natural stream channel flows northwest to Curtis Ponds.

- 3.2 Evaluation. The above findings indicate that the dam has several signs of distress which require attention. It is evident that the dam is not adequately maintained and that deterioration will continue unless action is taken. Recommended measures to improve these conditions are included in Section 7.

## SECTION 4

### OPERATING PROCEDURES

- 4.1 Procedures. There are no operating procedures at Leesville Pond Dam.
- 4.2 Maintenance of Dam. Records indicate that no work has been done on the dam in almost 25 years. The dam is inadequately maintained and appears to have rapidly deteriorated in the last 10 years. The 1973 inspection report by the Massachusetts Department of Public Works (see Appendix B) calls for restoration of the eroded downstream slope at the westerly (southwest) side of the dam, and removal of brush and trees from the embankment, but makes no mention of the existing leakage around the outlet, or the faulty gate mechanism.
- 4.3 Maintenance of Operating Facilities. The outlet mechanism is inoperable. The slide gates are closed and cannot be opened with the existing mechanism.
- 4.4 Description of Any Warning Systems in Effect. There are no warning systems in effect at this dam.
- 4.5 Evaluation. There are no operational, maintenance, or warning systems in effect at Leesville Pond Dam. Because this dam is in the "significant" hazard category, the situation should be rectified. A program of operation and maintenance for this dam should be implemented as recommended in Section 7.

## SECTION 5

### HYDRAULIC/HYDROLOGIC

#### 5.1 Evaluation of Features

- a. Design Data. The Probable Maximum Flood (PMF) of 31,000 cfs is based on a U. S. Army Corps of Engineers' Hydrologic Analysis: Blackstone River Flood Control, Worcester Diversion, dated August 1956. By using one-half the PMF and adjusting it for the effect of the Worcester Diversion, the inflow test flood for Leesville Pond was calculated to be 9,160 cfs. After adjusting this inflow for surcharge storage, the maximum discharge rate was established as 8,600 cfs with a water surface at El 493.6, which is 5.3 feet above the north abutment of the spillway (lowest point on the crest of the dam).

The spillway can discharge this rate with the pond at El 485.9, which is below the top of the dam. The existing spillway without flashboards can discharge a flow of 1,594 cfs at El 488.3, the elevation of the north abutment of the spillway.

- b. Experience Data. Below is a summary of the highest floods recorded on Kettle Brook at Worcester (1932-1978) which was obtained from the above-referenced Corps of Engineers report and from a review of the gaging station records from 1955 to 1978:

<u>Date</u>	<u>Peak discharge (cfs)</u>
August 19, 1955	3,970
March 18, 1936	2,520
September 12, 1954	1,530
March 12, 1936	1,340
September 21, 1938	1,300
January 10, 1935	1,020



Past inspection reports state that the dam was overtopped in the 1955 flood by about 1 foot (El 491+).

- c. Visual Observations. Discharge from Leesville Pond is over the main spillway and through two wooden gates located at the right abutment (see Figure B-1). The gates, however, are closed and are inoperable and therefore all discharge must be over the main spillway.

The visual inspection on July 24, 1978, found the spillway to be in fair condition. There are minor leaks between the spillway and gate structure and the concrete weir at the spillway shows signs of erosion.

An inspection of the Worcester Diversion on July 24, 1978, found that the dam, spillway, and tunnel are in excellent condition. Flow in Kettle Brook was passing through one of the slide gates. The existing water level was about 3 feet below the weir of the overflow intake.

- d. Overtopping Potential. Overtopping of the dam by about 3 feet is expected under an outflow test flood of 8,600 cfs. As noted previously, however, the records on overtopping indicate that the dam was overtopped in 1955 by about 1 foot. The peak discharge for the 1955 flood was 3,970 cfs.

Presently, the Worcester Diversion will divert a significant amount of any storm flow. For example, for a maximum discharge of 6,000 cfs through the diversion plus a spillway flow of 1,594 cfs at Leesville Pond, the maximum discharge of Kettle Brook will be 7,594 cfs without overtopping Leesville Pond Dam. Because this discharge is nearly twice the maximum recorded discharge at this site, the potential for overtopping is remote.

In the event of overtopping, complete failure of the dam could occur. The resulting flood wave could cause significant loss of life and appreciable property damage if Curtis Pond Dam failed.

The outflow discharge rate under failure conditions has been calculated as about 16,000 cfs. This results in a flood wave 12 feet high 1,900 feet downstream from the dam.

## SECTION 6

### STRUCTURAL STABILITY

#### 6.1 Evaluation of Structural Stability

- a. Visual Observations. The evaluation of the structural stability of Leesville Pond Dam is mainly based on the visual inspection conducted on July 24, 1978. As discussed in Section 3, Visual Inspection, there were several visible signs of distress.

It is recommended that a more detailed investigation be initiated to evaluate the stability of the dam and seepage at the downstream toe of the spillway sidewall.

- b. Design and Construction Data. Discussions with the Owner and County, and State personnel indicate that there are two plans but no specifications or computations relative to the design or construction of this dam. Furthermore, information on the type, shear strength, and permeability of the soil and/or rock materials of the dam embankment apparently does not exist.

The reconstruction of the Leesville Pond Dam embankment, as shown in Figure B-3, shows a proposed impervious core of wood backfilled with blue clay. This is the only data available on the materials comprising the dam embankment.

- c. Operating Records. There is no evidence that instrumentation of any type was ever installed in Leesville Pond Dam. The performance of this dam under prior loading can only be inferred from previous records and physical evidence at the site.

- d. Post-Construction Changes. Leesville Pond Dam has undergone at least three major stages of reconstruction as described in Section 1.2.h., Design and Construction History. There are no as-built drawings for the dam or spillway, however.
- e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analyses.

## SECTION 7

### ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

#### 7.1 Dam Assessment

- a. Condition Leesville Pond Dam has undergone several stages of reconstruction. Due to its age, the dam was neither designed nor constructed according to current approved state-of-the-art procedures. Based upon the visual inspection at the site, the lack of complete engineering data, and the lack of operational and maintenance information, there are areas of concern which must be corrected to assure the continued performance of the dam. Generally, the dam is considered to be in fair condition, although there are several signs of distress: inoperable slide gates, leakage around the slide gates, seepage at the downstream toe of the north abutment of the spillway, steep embankment slopes near the abutments of the dam, erosion of the downstream slopes on the abutments, erosion of the concrete in the training walls of the outlet intake channel, heavy growth of trees and brush on the dam embankment and downstream areas, slumping and erosion of the soil and lack of sufficient riprap on the upstream face of the dam, and wood and trash debris in the outlet channel and in the stream bed.

Hydraulic analyses indicate that the spillway can discharge a flow of 1,594 cfs at El 488.3 which is the elevation of the concrete abutment on the north end of the spillway and the lowest point on the dam crest. An outflow test flood of 8,600 cfs (half of the probable maximum flood minus the diverted flow) will overtop the main dam by about 3 feet. Previous records at this site indicate the dam was overtopped by 1 foot during the 1955 floods. With the present regulating effects of the upstream flood control structure, it is unlikely that overtopping is any longer a serious hazard.

- b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.
- c. Urgency. The recommendations and remedial measures outlined below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.
- d. Need for Additional Information. Additional investigations to further assess the adequacy of the dam and appurtenant structures are outlined below in Section 7.2, Recommendations.

7.2 Recommendations. In view of the concerns on the continued performance of this dam, it is recommended that the Owner employ a qualified consultant to:

- a. Evaluate the stability of the dam, and
- b. Evaluate the seepage at the north abutment of the spillway.

The recommendations on repairs and maintenance procedures are stated below under Section 7.3, Remedial Measures.

### 7.3 Remedial Measures

- a. Alternatives. An alternative to the recommendations in Section 7.2 and the maintenance procedures itemized below would be draining the reservoir and breaching or removing the dam.
- b. Operating and Maintenance Procedures. The dam and appurtenant structures are not adequately maintained. It is recommended that the Owner accomplish the following:
  - (1) repair the gate mechanism and clear the outlet channel of trash and debris
  - (2) repair the concrete on the approach channel

- (3) cut down trees and clear brush from both embankments, the sides of the outlet channel, and the toe of the north spillway abutment
- (4) repair eroded areas of the downstream face of the abutments, and replace the rip-rap on the upstream face of the dam
- (5) fill in the waste pipe outlet with concrete
- (6) clear wood and trash debris from the stream bed below the spillway cascade
- (7) institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff; this should be coordinated with the operators of upstream reservoirs
- (8) implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations.
- (9) periodic technical inspections of this dam should be continued on a bi-annual frequency.

APPENDIX A  
PERIODIC INSPECTION  
CHECKLIST



# PERIODIC INSPECTION

## PARTY ORGANIZATION

PROJECT Lecsville Pond Dam

DATE July 24, 1978

TIME 1:00 - 5:00 PM

WEATHER sunny - 75°

W.S. ELEV. 485\* U.S. \_\_\_\_\_ DN.S. \_\_\_\_\_

\*assumed benchmark top of spillway apron, upstream edge

### PARTY:

- |                         |                         |
|-------------------------|-------------------------|
| 1. <u>Ed Greco</u>      | 6. <u>Lyle Branagan</u> |
| 2. <u>Dick Weber</u>    | 7. <u>Carol Sweet</u>   |
| 3. <u>Sue Pierce</u>    | 8. _____                |
| 4. <u>Frank Sviokla</u> | 9. _____                |
| 5. <u>David Cole</u>    | 10. _____               |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>dam</u>	<u>Ed Greco / Dick Weber</u>	
2. <u>Spillway</u>	<u>Lyle Branagan</u>	
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

# PERIODIC INSPECTION CHECK LIST

PROJECT Leesville Pond dam DATE July 24, 1978  
 PROJECT FEATURE dam NAME Ed Greco  
 DISCIPLINE geotechnical NAME Dick Weber

Note: ds = downstream us = upstream

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	crest is concrete w/ concrete core wall along ds edge, rem section has stone wall partway down ds face
Crest Elevation	
Current Pool Elevation	485
Maximum Impoundment to Date	unknown
Surface Cracks	joints in concrete core wall - slight spalling
Pavement Condition	none
Movement or Settlement of Crest	none visible
Lateral Movement	none visible
Vertical Alignment	flat
Horizontal Alignment	straight
Condition at Abutment* and at Concrete Structures	concrete crest + core wall tie into natural ground
Indications of Movement of Structural Items on Slopes	none visible
Trespassing on Slopes	footpaths to north abutment
Sloughing or Erosion of Slopes or Abutments	west side: erosion on us + ds slopes near abutment w/ natural ground tree + brush growth both sides on us + ds faces
Rock Slope Protection - Riprap Failures	south side: random rip rap us face w/ sloughing some overgrown w/ brush north side: some random rip rap us face
Unusual Movement or Cracking at or near Toes	none visible
Unusual Embankment or Downstream Seepage	none visible
Piping or Boils	none visible
Foundation Drainage Features	none visible
Toe Drains	none visible
Instrumentation System	none visible

\* 12" x 18" trees on us face south embankment, brush growth ds face, roots growing into concrete

# PERIODIC INSPECTION CHECK LIST

PROJECT Leesville Pond Dam  
 PROJECT FEATURE spillway  
 DISCIPLINE geotechnical

DATE July 24, 1978  
 NAME Lyle Brangan  
 NAME Ed Greco

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	none
General Condition	none
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	none
Floor of Approach Channel	none
b. Weir and Training Walls	concrete training walls, sloped concrete weir, support holes for flashboard pins at 2' spacing
General Condition of Concrete	minor spalling & erosion on training walls, weir concrete fair,
Rust or Staining	none visible
Spalling	none visible
Any Visible Reinforcing	none visible
Any Seepage or Efflorescence	none visible
Drain Holes	none visible
c. Discharge Channel *	cascade stone spillway
General Condition	fair
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	tree at toe of north sidewall - seepage from stonework at roots
Floor of Channel	stone steps - downstream is natural stream bed
Other Obstructions	

\* southside of spillway is 29ft across, sloped face, with circular 4ft diameter opening, extends 17 ft under spillway crest

## PERIODIC INSPECTION CHECK LIST

PROJECT Leesville Pond DamDATE July 24, 1978PROJECT FEATURE approach to slide gatesNAME Ed GrecoDISCIPLINE geotechnicalNAME Dick Weber

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	<u>concrete sidewalls</u>
a. Approach Channel	
Slope Conditions	<u>not visible</u>
Bottom Conditions	<u>not visible</u>
Rock Slides or Falls	<u>none</u>
Log Boom	<u>none</u>
Debris	<u>none</u>
Condition of Concrete <del>Lining</del>	<u>cracking along joints + 2' key way on sidewalls, erosion along water line</u>
Drains or Weep Holes	<u>none visible</u>
b. Intake Structure	
Condition of Concrete	} <u>see slide gates, A-5</u>
Stop Logs and Slots	

# PERIODIC INSPECTION CHECK LIST

PROJECT Leesville Pond Dam

DATE July 24, 1978

PROJECT FEATURE slide gates

NAME Ed Greco

DISCIPLINE geotechnical

NAME Dick Weber

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE * AND OUTLET CHANNEL</u>	2 wooden slide gates 5' x 5' concrete sidewalls + overhead slab w/ track + pinon mechanisms
General Condition of Concrete	fair - minor spalling + cracking
Rust or Staining	none
Spalling	minor local spalling
Erosion or Cavitation	minor erosion of concrete along water line
Visible Reinforcing	none
Any Seepage or Efflorescence	leakage along top of both slide gates
Condition at Joints	minor spalling
Drain Holes	none visible
Channel	concrete bottom + sidewalls
Loose Rock or Trees Over- hanging Channel	1 large + several smaller trees + brush growth over channel
Condition of Discharge Channel	Scattered wood + trash debris

## APPENDIX B

	<u>Page</u>
Figure B-1, Plan of Dam	B-1
Figure B-2, Sections	B-2
Figure B-3, Plan of Waste Gate Works Across Leesville Pond, filed December 1936	In Pocket
Figure B-4, Plan of Reconstruction of Dam on Leesville Pond, filed December 1955	In Pocket
Previous Inspections (Partial Listing)	B-5
Letter Report to Mr. Eli Jacobson	B-7
Inspection Report from Massachusetts Department of Public Works, January 1973	B-8

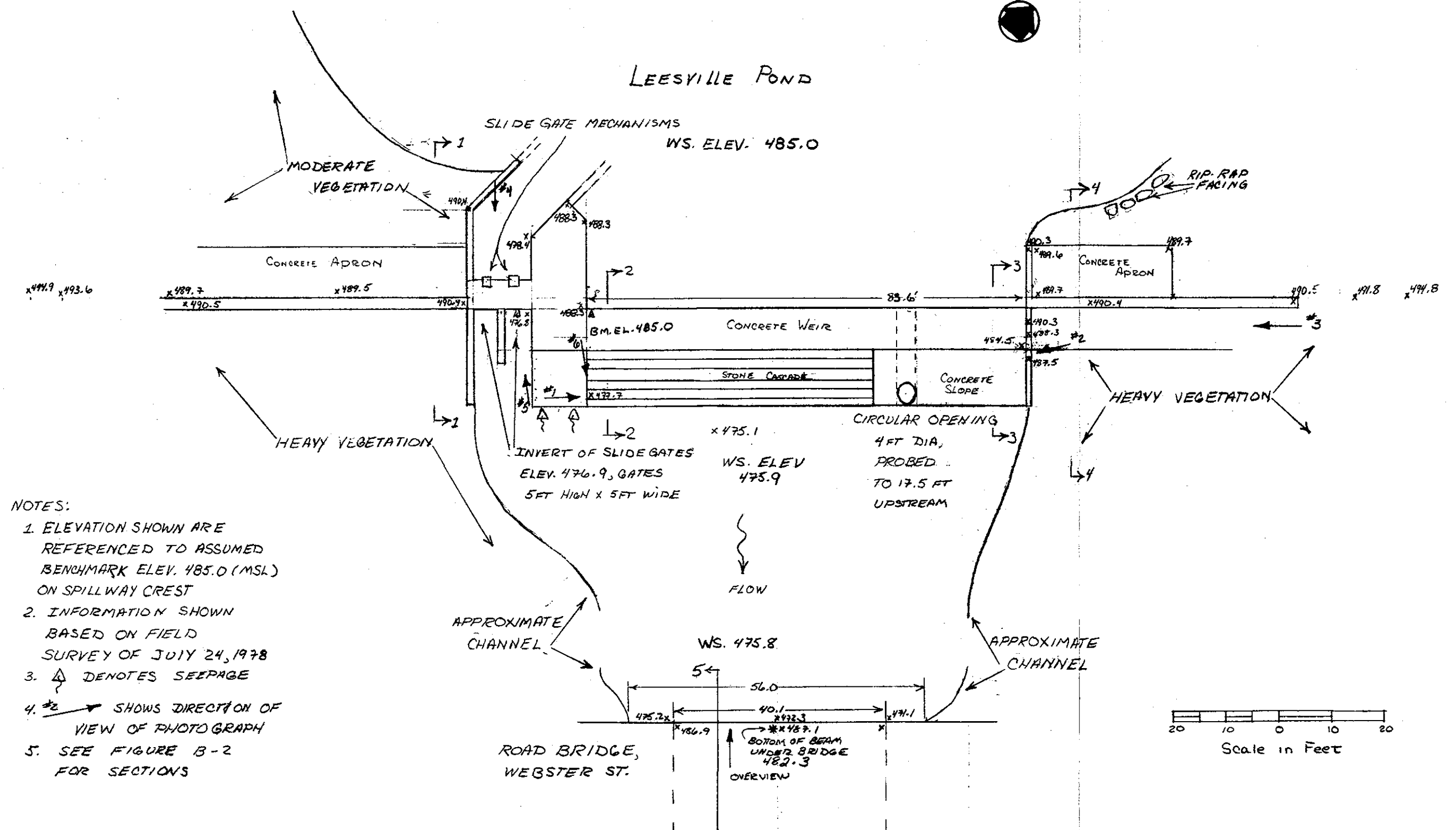
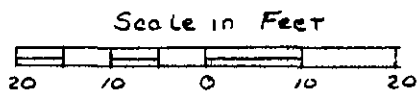
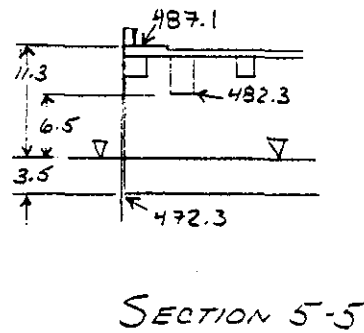
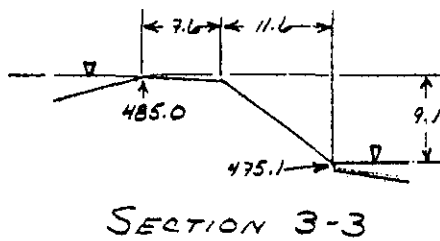
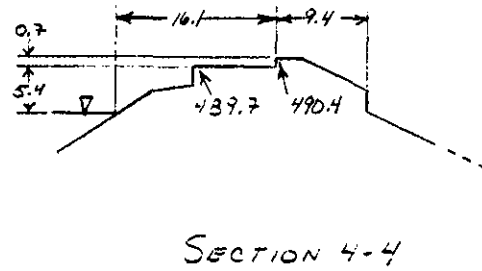
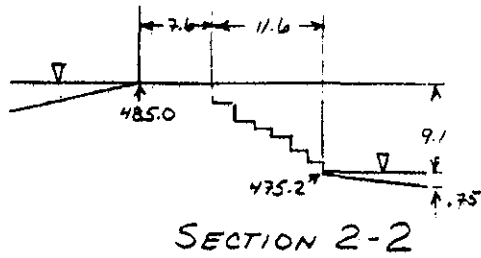
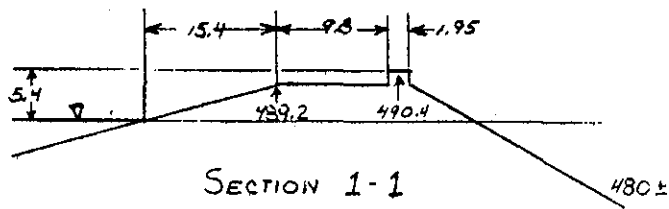


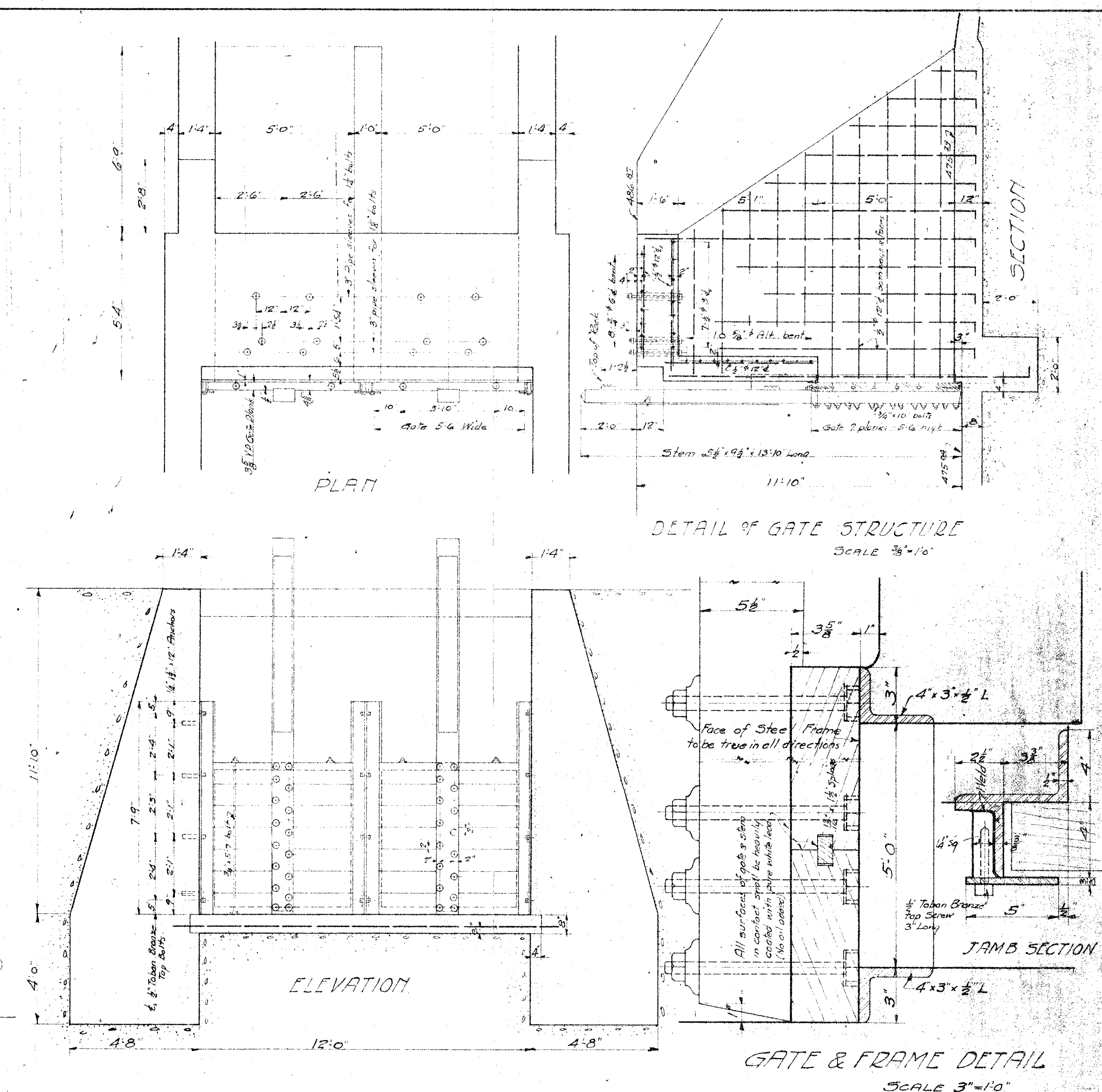
FIGURE B-1 PLAN OF DAM



Metcalf & Eddy, Inc

FIGURE B-2 SECTIONS





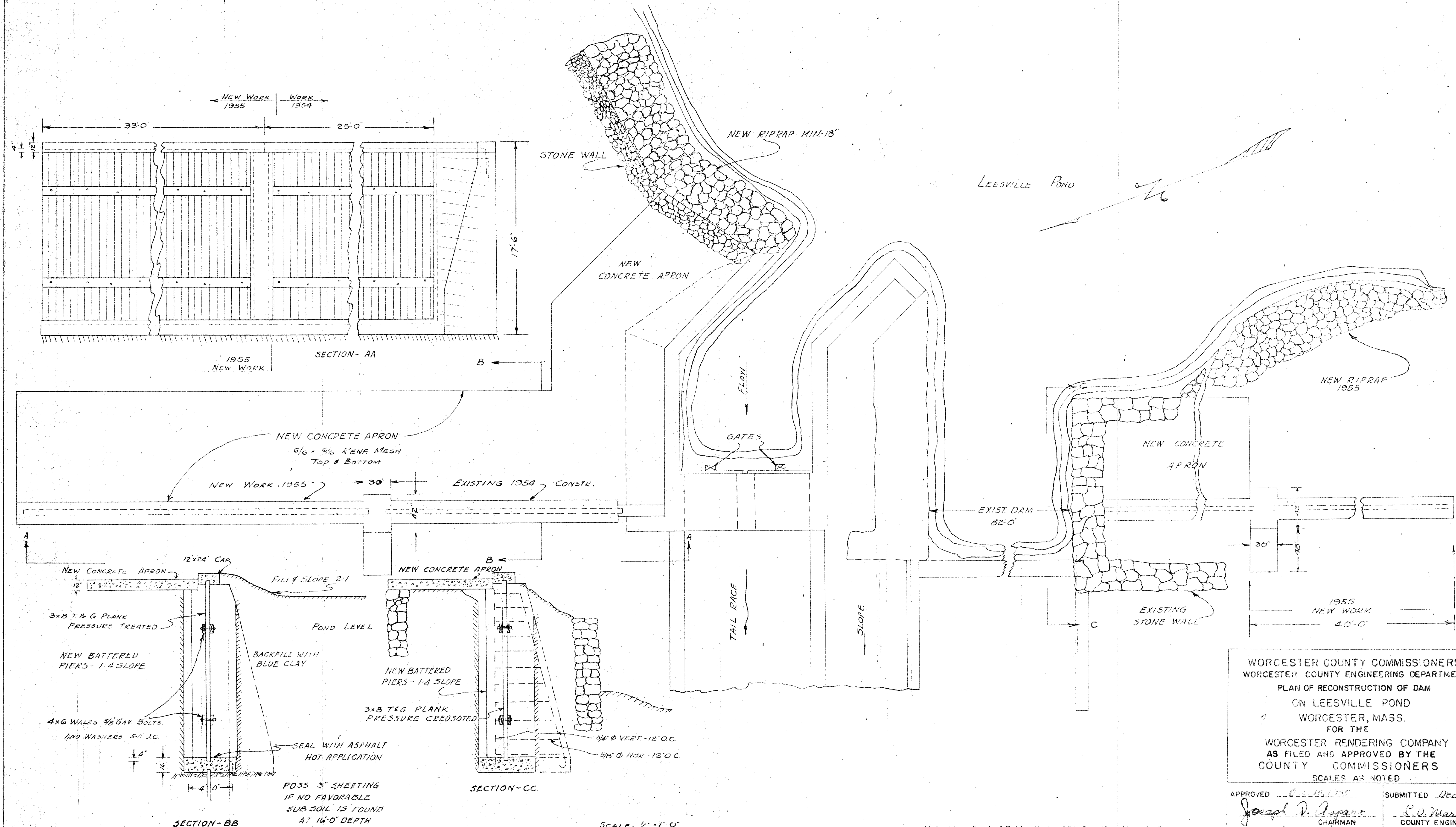
Approved: <u>12-29-36</u>	Submitted For Approval: <u>12-29-36</u>
<u>Elbert M. Carpenter</u> Chairman, Board of County Commissioners	<u>P.O. Marden</u> County Engineer
<u>George W. Jones</u> County Commissioner	Engineer & Contractor: <u>E. J. Cross Co., Worcester Mass. 11-24-36</u>
<u>County Commissioner</u>	DAM NO. 61-15

Size	Wing	Length	Mark	Shots	Location
1/2	11	5-3	41		Cut-off - Greenham Apron
3/4	11	5-0	61		do do - Gals Shuchus
1/2	10	14-6			do do - Gals respective Floor
3/4	8	13-0			Cut-offs
1/2	2	1-10	43		Conkwell Canal
	2	5-4	42	L	do do
	2	4-10	54	L	do do
	2	6-4	45	L	do do
	2	7-10	56	L	do do
	2	10-4	47	L	do do
10	12	4	58	L	do do
	2	13-0	49		do do
	2	5-4			do Horizontal
	2	6-0			do do
	2	6-8			do do
	2	7-4			do do
	2	8-0			do do
	2	9-8			do do
	2	9-4			do do
	2	10-0			do do
	2	10-8			do do
	2	11-4			do do
1/2	5	14-0			do do
	10	10-0	51		do well
1/2	11	5-3			do do
3/4	18	13-0			do do - Top
1/2	11	4-0	62		do do
1/2	11	5-0			do do - Bottom
1/2	7	13-3			do do
1/2	6-0	1-8			do do - Bottoms Being
2 1/2	11	13-0	13-0		Down stream apron
1 1/2	10-0	10-0			Up stream apron

BOLT LIST					Location
*Wtd	Size	Length	Threads	Remarks	
4	1/4"	2 1/2"	2 1/2"	Sp. Hds & Nut, 4 P-4's & washers	Moist
8	3/16"	2 1/2"	2 1/2"	do	du
12	3/16"	1 1/2"	2 1/2"	Shower Black Iron Pipe	du
6	3/16"	2 1/2"	2 1/2"	Sp. Hds, Nut, Cuts & I. Washers	Gale

FIGURE B-3





WORCESTER COUNTY COMMISSIONERS  
 WORCESTER COUNTY ENGINEERING DEPARTMENT  
 PLAN OF RECONSTRUCTION OF DAM  
 ON LEESVILLE POND  
 WORCESTER, MASS.  
 FOR THE  
 WORCESTER RENDERING COMPANY  
 AS FILED AND APPROVED BY THE  
 COUNTY COMMISSIONERS  
 SCALES AS NOTED

APPROVED <i>Dec 15, 1955</i> <i>Joseph P. Asaro</i> CHAIRMAN	SUBMITTED <i>Dec 15, 1955</i> <i>R. O. Marden</i> COUNTY ENGINEER
<i>Francis O. Cassidy</i> <i>Edward P. Sullivan</i>	ENGINEERS R.H. WHITE CONSTR. CO. DAM NO. 61-15

Note: Mass Dept of Public Works 1953 Specifications to Govern

FIGURE B-4

TOWN OR CITY	Worcester		DECREE NO.	PLAN NO.	11.1	DAM NO.	348-15
LOCATION	Leesville pond - Webster St.		C. C. DOCKET NO.				
DESCRIPTION OF DAM				DESCRIPTION OF RESERVOIR & WATERSHED			
Type	Earth <sup>Northerly stone abt.</sup> Stepped stone spillway 65' vert. walls - 29'		Name of Main Stream	" " any other Streams			
Length	150'		Length of Watershed	(Traced and Approved)			
Height	12'		Width " "				
Thickness top	20'		Is Watershed Cultivated				
" bottom	spill - 30'		Percent in Forests				
Downstream Slope	stepped & vertical		Steepness of Slope				
Upstream " "	prob 2:1		Kind of Soil	Ledge - Hardpan			
Length of Spillway	El. crest 97.0		No. of Acres in Watershed	31.27 3/8 M			
Size of Gates	one No. end 42" one spill 42" El. 100.0		" " " Reservoir	26			
Location of Gates			Length of Reservoir				
Flashboards used	El. 99.0 wood.		Width " "				
Width Flashboards or Gates	24'		Max Flow Cu. Ft. per Sec.				
Dam designed by	Unknown.		Head or Flashboards-Low Water				
" constructed by			" " " High "				
Year constructed			GENERAL REMARKS				
GENERAL REMARKS				GENERAL REMARKS			
Lowell Fertilizer Co - owners.				Inspected: Feb. 25, 1929 X L. O. Marden.			
1928 Worcester Rendering Co., owners.				" : Mar. 7, 1929 X " "			
* 18 Southbridge St., Worcester				" " June 26, " " "			
OWNER - ELI JACOBSON - 5 ROLLINGWOOD DR.				" " Dec. 17, 1931 - " "			
Dec. 17, 1925 X L. O. Marden.				" Mar. 18, 1936 - L. O. M., Mr. Fish			
Inspected: Oct. 27, 1928 X L. O. Marden.				" Mar. 24, 1937 - " R. Cross, Mr. Seeman.			
" Jan. 2, 1929 X " (over)				" Jan. 5, 1937 - " R. V. Cross			
				1936 Flood 469.5 30 above crest of Dam			

PREVIOUS INSPECTIONS (PARTIAL LISTING)

COPY OF INSPECTION CARD ON FILE AT THE MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS, DISTRICT OFFICE, WORCESTER.

Inspected: Jan. 6, 1937 - L.O.M., E.M. Crockett

61-15

New Plans & Specs approved: 12-29-36 by C.C.

Inspected: Nov. 23, 1935 L.O.M., Cross & Mr. Fish

" : April 14, 1936 " " Mr. Fish  
" : June 23, 1937 " " E.M. Crockett  
" : May 6, 1937 " " R. U. Cress  
" : Nov. 18, 1938 L. H. Spofford  
" : Dec. 9, 1940 " " "  
" : Dec. 11, 1945 - W.O. Lindquist

1936 Repairs: new gates & frame

CRD

4/2

April 2, 1973

Mr. Ed Jacobson  
5 Hollingswood Drive  
Worcester, Massachusetts

RE: Inspection-Dam #3-14-343-15<sup>14</sup>  
Worcester  
Leicester Dam

Dear Mr. Jacobson:

An engineer from the Massachusetts Department of Public Works has inspected the above dam, of which you are the owner.

The inspection was made in accordance with Chapter 253 of the Massachusetts General Laws, as amended by Chapter 595 of the Acts of 1970.

The results of the inspection indicate that this dam is safe; however, the following conditions were noted that require attention:

1. Restore the eroded downstream slope at the westerly side of the dam.
2. Remove the growth of trees and brush from the abutment.

We call these conditions to your attention now, before they become serious and expensive to correct.

Very truly yours,

*F.C. Schwelb*  
FRED. C. SCHWELB, P.E.  
Deputy Chief Engineer

*J.P.M.*  
LM:/cfo  
cc: G. E. Lyford MEM/3  
A. Tolano LIC/3

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town WORCESTER Dam No. 3-14-348-15  
Name of Dam LEESVILLE Inspected by MULLANEY  
JANUARY 1973  
Date of Inspection 1-23-73

2. Owner/s: per: Assessors \_\_\_\_\_ Prev. Inspection ✓

Reg. of Deeds \_\_\_\_\_ Pers. Contact \_\_\_\_\_

1. ELI JACOBSON 5 ROLLINGWOOD DR WORCESTER  
Name St. & No. City/Town State Tel. No.  
2. \_\_\_\_\_  
Name St. & No. City/Town State Tel. No.  
3. \_\_\_\_\_  
Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: \_\_\_\_\_ St. & No.: \_\_\_\_\_  
City/Town: \_\_\_\_\_ State: \_\_\_\_\_ Tel.No.: \_\_\_\_\_

4. No. of Pictures taken \_\_\_\_\_

5. Degree of Hazard: (if dam should fail completely)\*

1. Minor \_\_\_\_\_ 2. Moderate ✓  
3. Severe \_\_\_\_\_ 4. Disastrous \_\_\_\_\_

\* This rating may change as land use changes (future development)

6. Outlet Control: Automatic \_\_\_\_\_ Manual ✓  
Operative \_\_\_\_\_ yes; \_\_\_\_\_ No.

Comments:

7. Upstream Face of Dam: Conditions:

1. Good ✓ 2. Minor Repairs \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments:

8. Downstream Face of Dam:

Condition: 1. Good ✓ 2. Minor Repairs \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments:

9. Emergency Spillway: NONE

Condition: 1. Good ✓ 2. Minor Repairs \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments:

10. Water Level at time of inspection: 5' ft. above \_\_\_\_\_ below ✓  
top of dam ✓ principal spillway \_\_\_\_\_  
other \_\_\_\_\_

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment YES

Animal Burrows and Washouts NONE

Damage to slopes or top of dam NONE

Cracked or Damaged Masonry NONE

Evidence of Seepage NONE

Evidence of Piping NONE

Erosion SOME ON DOWNSTREAM SLOPE BEHIND RETAINING WALL ON LEFT

Leaks NONE

Trash and/or debris impeding flow SMALL AMT OF DEBRIS

Clogged or blocked spillway NONE

Other \_\_\_\_\_

12. Remarks and Recommendations: (Fully Explain)

THE OVERALL GENERAL CONDITION OF THE DAM IS GOOD; THERE IS SOME DEBRIS ON THE DOWNSTREAM FACE OF DAM THAT SHOULD BE REMOVED. EROSION OF THE SLOPE ON THE LEFT SIDE OF THE DOWNSTREAM FACE OF THE DAM SHOULD BE COLLECTED. THE CONCRETE SECTIONS OF THE DAM AND THE DOUBLE EXPOSED CHANNEL APPEAR TO BE IN GOOD CONDITION

13. Overall Condition:

1. Safe ☒
2. Minor repairs needed ☒
3. Conditionally safe - major repairs needed ☐
4. Unsafe ☐
5. Reservoir impoundment no longer exists (explain)  
Recommend removal from inspection list ☐



# DESCRIPTION OF DAM

DISTRICT 3

Submitted by MULLANEY, DONAHUE, MULLANEY Dam No. 3-14-344-15  
 Date 1-23-73 City/Town WORCESTER  
 Name of Dam LEESVILLE DAM

1. Location: Topo Sheet No. 213

Provide 8 1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: \_\_\_\_\_ Year/s of subsequent repairs \_\_\_\_\_

3. Purpose of Dam: Water Supply \_\_\_\_\_ Recreational \_\_\_\_\_  
 Irrigation \_\_\_\_\_ Other ☒

4. Drainage Area: 31.27 sq. mi. \_\_\_\_\_ acres

5. Normal Ponding Area: 26 acres; Ave. depth \_\_\_\_\_

Impoundment: \_\_\_\_\_ gals.; \_\_\_\_\_ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir  
4 wood frame  
1 stone i.e. summer homes, etc. \_\_\_\_\_

7. Dimensions of Dam: Length 215 1/2 Max. Height 16'

Slopes: Upstream Face 2:1 (V.H.R)

Downstream Face 1:1

Width across top \_\_\_\_\_

8. Classification of Dam by Materials:

Earth ☒ Conc. Masonry ☒ Stone Masonry ☒

Timber \_\_\_\_\_ Rockfill \_\_\_\_\_ Other \_\_\_\_\_

9. A. Description of present land usage downstream of dam:

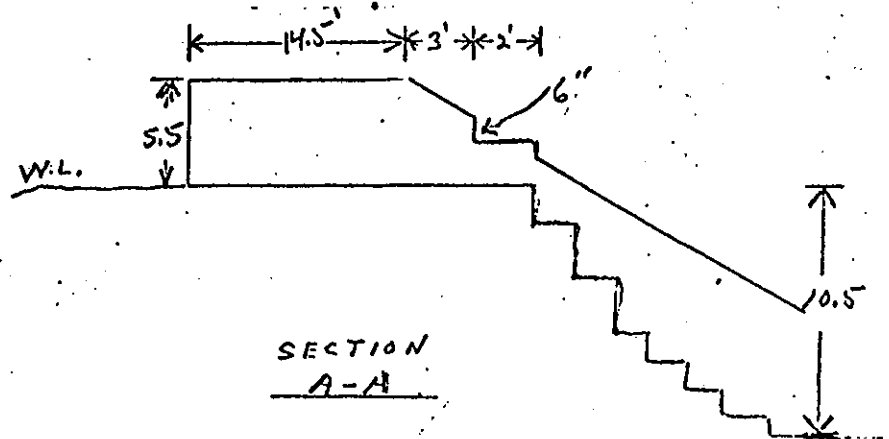
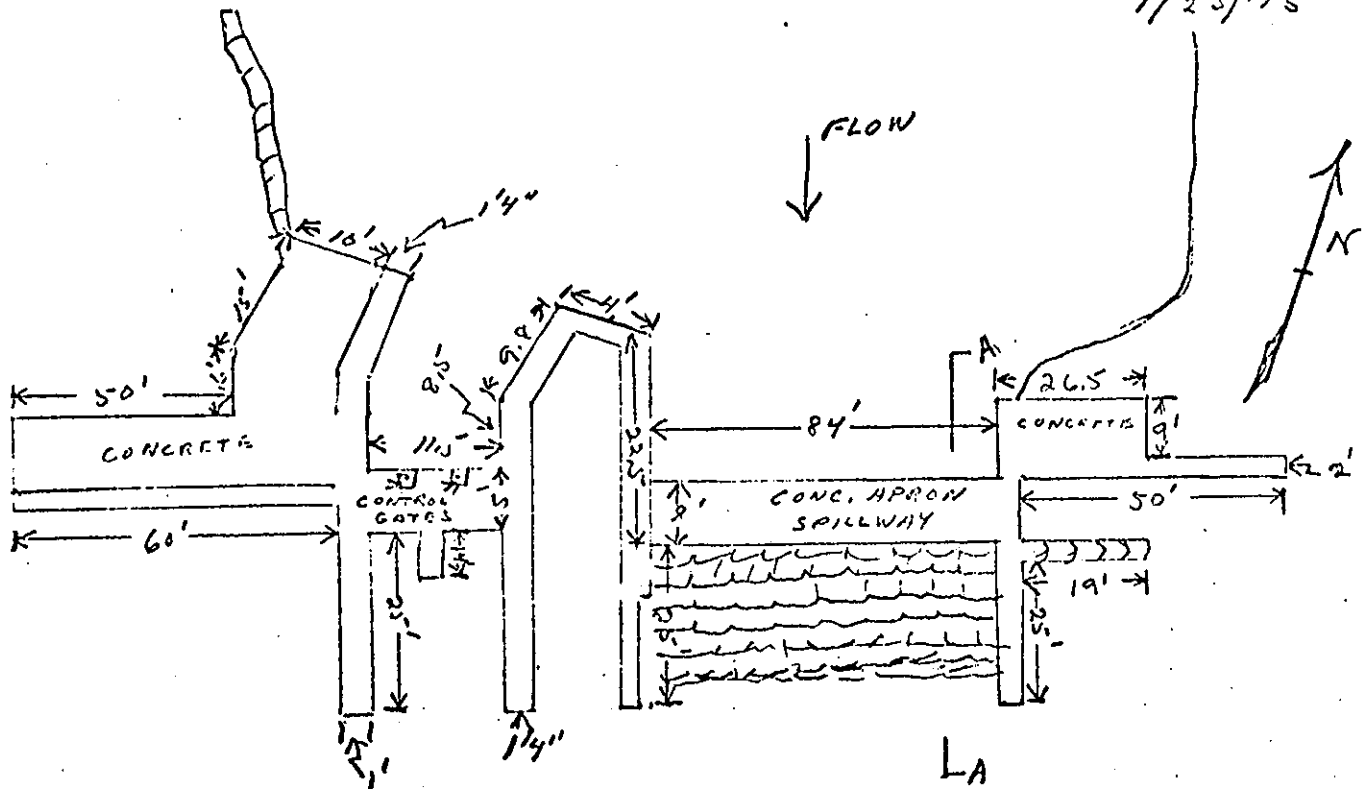
\_\_\_\_\_ % rural; 100 % urban.

B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes ☒ no \_\_\_\_\_

DAM # 3-14-347-15

LEESVILLE DAM

1/23/73



DAM NO. 3-14-348-15

10. Risk to life and property in event of complete failure.

No. of people 20.  
No. of homes 5.  
No. of Businesses 1.  
No. of industries NONE. Type \_\_\_\_\_  
No. of utilities NONE. Type \_\_\_\_\_  
Railroads NONE.  
Other dams NONE.  
Other \_\_\_\_\_.

11. Attach Sketch of dam to this form showing section and plan on 8 1/2" x 11" sheet.

12. How to Locate:

TAKG WEBSTER ST PAST HORN AVE. APPROX. 200'  
DAM VISIBLE ON LEFT.

APPENDIX C  
PHOTOGRAPHS



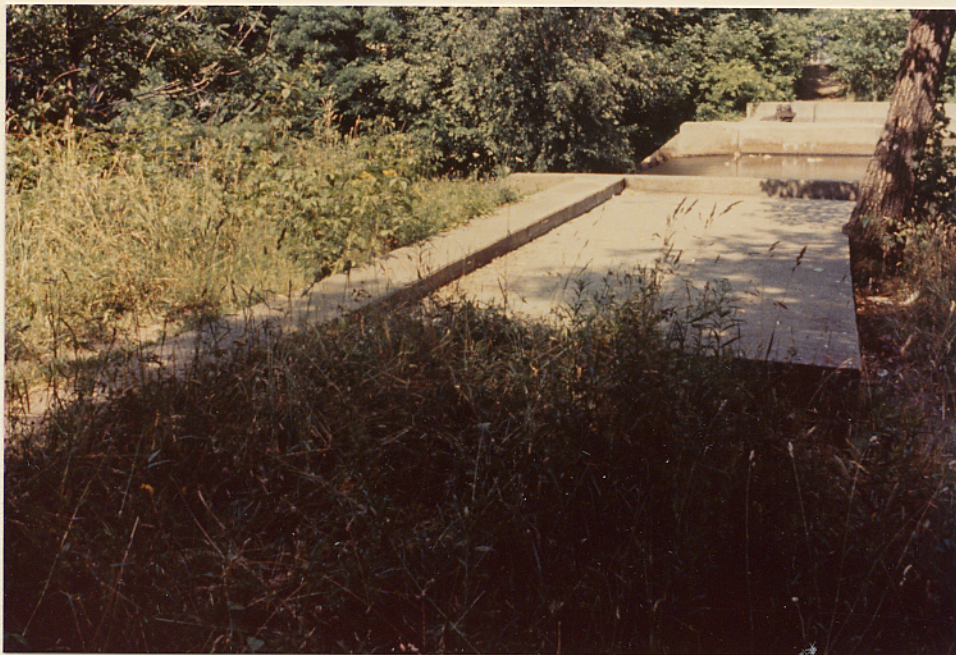


NO. 1 VIEW OF SPILLWAY CASCADE FROM NORTH ABUTMENT

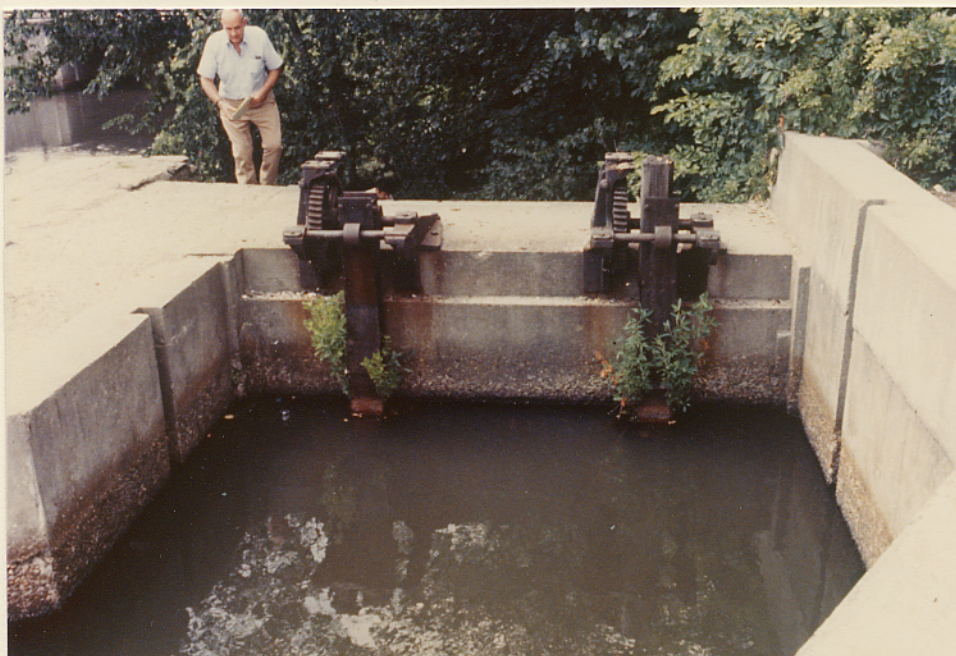


NO. 2 VIEW OF SPILLWAY FROM SOUTH ABUTMENT





**NO. 3 VIEW OF DAM CREST FROM SOUTH ABUTMENT**



**NO. 4 VIEW OF INTAKE CHANNEL**





NO. 5 VIEW OF DISCHARGE CHANNEL AND SLIDE GATES



NO. 6 VIEW OF CHANNEL DOWNSTREAM OF DAM

APPENDIX D  
HYDROLOGIC AND HYDRAULIC  
COMPUTATIONS

	<u>Page</u>
Computations	D-1
Figure D-1 Watershed Plan	In pocket



# (I) Inflow Test Flood & 100 Year Flood

A - Data taken from U.S.C. of E. Report:  
 Blackstone River Flood Control  
 Worcester Diversion  
 Design Memorandum No. 1  
 Hydrologic Analysis, 11/20/77

P.M.P. based flood gives 31,000 cfs as peak which would be based on a 24.32 inch rainfall in 24 hours with a max. 6 hour rain of 19 inches & 3hr max of 14.25 inches. The Design Storm used in the project (SPF) had a peak of 8000 cfs and is based on a 11.0 inch 24 rain, a max. 6hr. rain of 8.35 inches and a max. 3hr. rain of 6.68 inches. Drainage area is 32.1 sq. miles.

B - Due to low height of dam use  $\frac{1}{2}$  PMF as Inflow Test Flood  
 $\therefore$  Possible Inflow Test Flood = 15,500 cfs. (Not diversion.)

## C - Diversion Effect

Above C of E report provides a rating curve for diversion tunnel & control dam just up stream of Leesville Dam. At 15500 cfs the pond level at the diversion is El. 501. The  $\frac{1}{2}$  of the tunnel exit is El. 411. Under an 86' head the diversion flow is 6340 cfs. Subtracting this from 15500 cfs gives:

$$\therefore \text{Inflow Test Flood} = \underline{9160 \text{ cfs}}$$

## D - 100 Year Flood

For 4.7 inches of rain in 6 hours, less a minimal infiltration loss of 1.1 inches, the 100 year flood inflow peak is:  
 Peak Inflow  $Q_{100} = 31000 \left( \frac{4.7 - 1.1}{19 - 1.1} \right) = \underline{6234 \text{ cfs.}}$

Rating curve of diversion structure and control dam indicates that with this rate of inflow, the diversion would be about 6000 c.f.s.

$$\underline{\text{Thus Inflow 100 year flood} = 234 \text{ c.f.s.}}$$

## E - Storage Function

$$\text{For Inflow Test Flood: } Q_{out} = 9160 - \frac{9160}{9.5}(S) = 9160 - 964 S - F_t$$

## II Spillway, Dam Crest Capacity & Storage Function

For Broad Crested spillway:  $Q_s = 3.12 (84) H_s^{1.5} = 262 H_s^{1.5}$

For Dam Crest:  $Q_c = 2.55 [(13') H_{c1}^{1.5} + (112') H_{c2}^{1.5}]$

$H_s = 0 @ \text{Elev. } 485, H_{c1} = H_s - 3.33'; H_{c2} = H_s - 5.5'$

Pond Elev	$Q_s$	$Q_c$	$Q_{TOT.}$	S	FTF
485	0	—	0	0	
486	262	—	262	.037	
487	741	—	741	.082	
488	1361	—	1361	.135	
488.33	1594	—	1594		
489	2096	18	2114	.194	
490	2929	72	3001	.262	
491	3851	246	4097	.336	
492	4852	758	5610	.419	8756
493	5928	1464	7392	.508	8670
493.6	6608	1960	8568	.566	8614
494	7074	2317	9391	.606	8576

S = Pond Storage in terms of inches on total drainage area

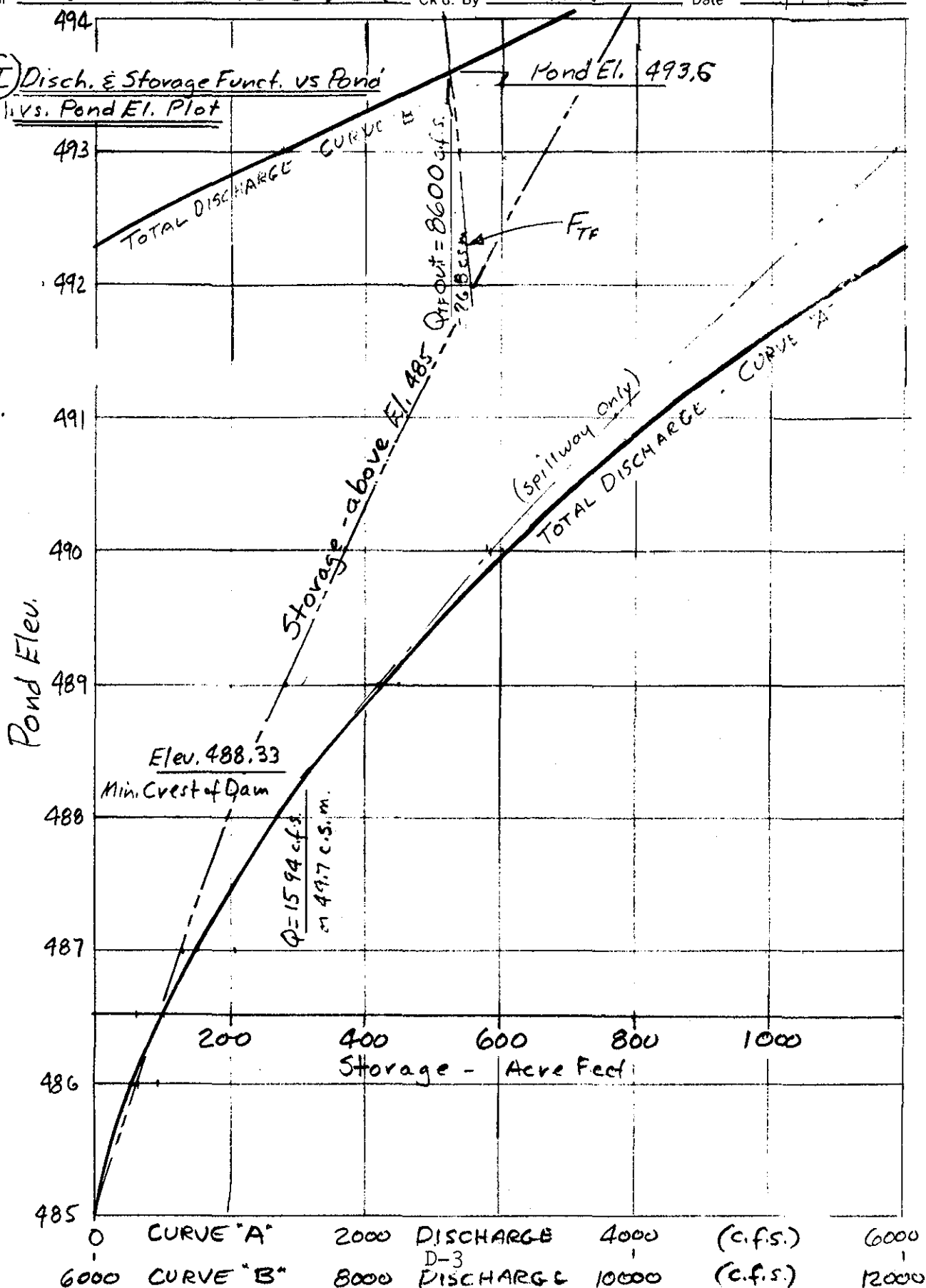
D = Depth in pond above spillway crest in feet ( $D = H_s$ )

Pond area =  $0.09 \text{ in}^2 @ \text{elev. } 485 \text{ to } 0.14 \text{ mi}^2 @ \text{elev } 490$

$\therefore \text{Area} = [0.09 + D(.01)] \text{ mi}^2$

$$\& S = 12 \left( \frac{.09 + D(.01)}{32.1} \right) D$$

III Disch. & Storage Funct. vs Pond  
Elev. vs. Pond El. Plot



#### IV Crest Flow

Under Test Flood Discharge:

$$\begin{aligned} \text{Total } Q_{out} &= 8600 \text{ (from Item III)} \\ \text{Spillway} &= 6493 \end{aligned}$$

$$\therefore \text{Total Crest Flow} = 2193$$

$$\text{Depth above Crest } z = 3', q_c = 2.55(3)^{1.5} = 13.25 \text{ cfs/ft.}$$

$$\text{Crit. Depth for } q, y_c = \left[ \frac{(13.25)^2}{g} \right]^{1/3} = 1.76'$$

$$\text{Crit Vel. for } q: V_c = \frac{13.25}{1.76} = 7.53 \text{ fps.}$$

#### V Low Outlet Discharge

Outlet consists of 2 - 5' x 5' sluiceways, inv. el. 476.9

Normal Pond Level - el. 485

[Ref. Chow, "Open Chan. Hydr." pg. 498, Fig. 17-29]

$$H = 8.1; H/d = 1.62, q = 56 \text{ cfs/ft.}$$

$$\text{Total Disch.} = (5+5)(56) = 560 \text{ cfs.} = 17.44 \text{ c.s.m.}$$

Above Disch. is 6.5% of Test Flood outflow

#### VI Storage

Pond area = 0.09 mi<sup>2</sup> @ El. 485 & 0.14 mi<sup>2</sup> @ El. 490  
 Extrapolated as shown:

Pond El.	Area	Incr. Vol (ac ft.)	Volume
485	0.09 mi <sup>2</sup>	60.8	0
486	0.10	67.2	60.8
487	0.11	153.6	128.0
489	0.13	86.4	281.6
490	0.14 mi <sup>2</sup>	92.8	368.0
491	0.15	99.2	460.8
492	0.16	105.6	560.0
493	0.17	112.0	665.6
494	0.18		777.6

## VII Failure of Dam

Peak Failure Flow:

Pond Elevation - 488.3

Toe Elevation - 474.5

$$Y_0 = 13.8$$

Dam Length Subject to Breaching = 139'

$$W_0 = 40\%(139) = 56'$$

$$Q_B = 1.68 W_0 (Y_0)^{1.5} = 1.68 (56) (13.8)^{1.5} = \underline{4800 \text{ cfs}}$$

Storage Volume Released:

Storage Above Spillway: From Graph

$$= 220 \text{ Ac. ft.}$$

Storage Below Spillway  $\frac{1}{3}(.09)(10.5)(640)$

$$= 200 \text{ " "}$$

S = Total Storage =

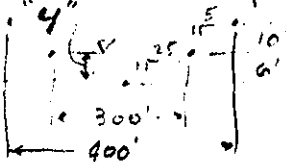
$$420 \text{ " "}$$

Spillway Flow = 1600 cfs; T.W. = 5.8', A = 841;  $Q_1 = 6400$

Channel Hydraulics:

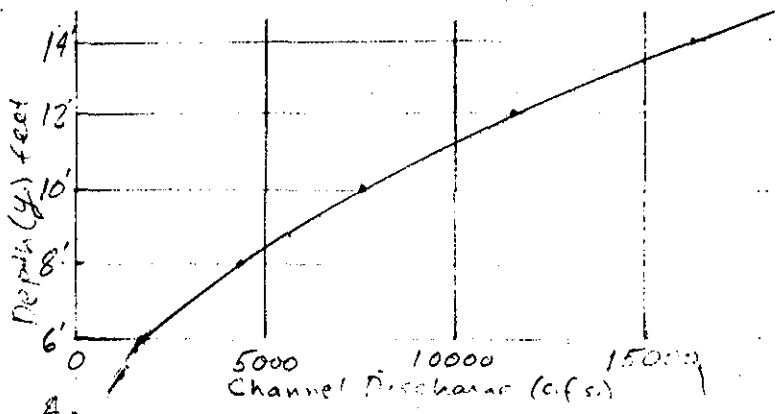
$$\text{Slope} = \frac{3}{1900} = .0016; n = .06$$

$$V = \frac{1.49}{n} R^{2/3} S^{1/2} = 1.0 R^{2/3}$$



y	A	P	$R^{2/3}$	V	Q
6'	900	300	2.08	2.08	1872
8'	1520	320	2.83	2.83	4295
10'	2180	340	3.45	3.45	7524
12'	2880	360	4.00	4.00	11520
14'	3620	380	4.50	4.50	16267
5'	625	250	1.84	1.84	1151

Channel Length 1900'



$$Q_1 = 6400; y_1 = 9.4'; A_1 = 1978; \Delta Vol_1 = 50 \text{ ac. ft.}$$

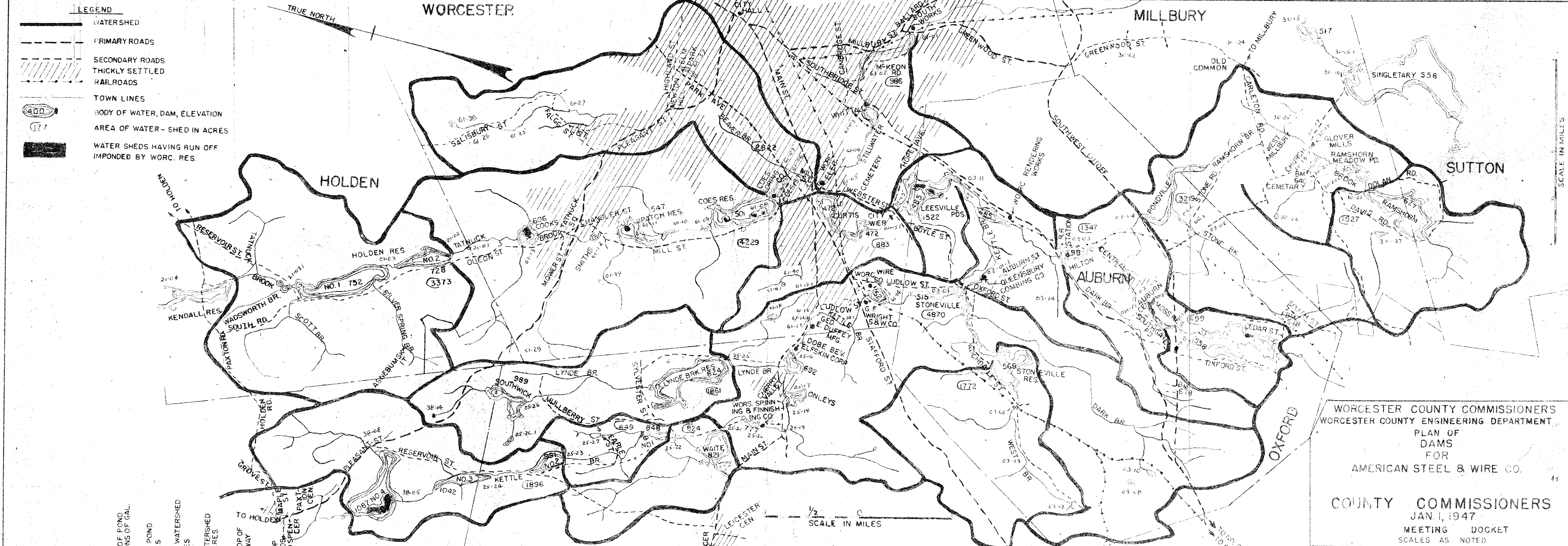
$$\text{Trial } Q_2 = 6400 \left(1 - \frac{50}{420}\right) = 5650 \text{ cfs. ; Wave Ht} \approx 8.9'; A_2 = 1812$$

$$\bar{A} = 1895, \Delta \bar{V} = 46; Q_{\text{Final}} = 6400 \left(1 - \frac{46}{420}\right) = 5700 \text{ cfs; } y_F = 8.9'; \Delta y = 3.1'$$

Time to Drain:

$$\frac{43560 (840)}{3600 (1/2) (4800)} = \underline{4.2 \text{ Hours}}$$





WORCESTER COUNTY COMMISSIONERS  
WORCESTER COUNTY ENGINEERING DEPARTMENT  
PLAN OF  
DAMS  
FOR  
AMERICAN STEEL & WIRE CO.

COUNTY COMMISSIONERS  
JAN. 1, 1947  
MEETING DOCKET  
SCALES AS NOTED

TRACED BY: J.P.P.  
TRACING CHECKED BY: W.O.L.  
DAM NO. 17720  
COUNTY ENGINEER

POND NAME	CAPACITY OF POND IN MILLIONS OF GAL.	AREA OF POND IN ACRES	INDIVIDUAL WATERSHED IN ACRES	TOTAL WATERSHED IN ACRES	ELEV. OF TOP OF DAM SPILLWAY	ELEV. OF TOP OF FLASHBOLT	YEAR BUILT	TYPE OF DAM	HIGH WATER MARK & WATER RIGHTS	YEAR ESTABLISHED	FLOW CONTROLLED BY	MISC. INFORMATION
61-02 CENTRAL WORKS	5.3	5.3			443.40		1814 <sup>1</sup> 1899	EARTH MASONRY TIMBER CORE PLAN B 177 1899 REPAIRS 1936 PLAN 12718	ELEV. 443.47 COPPER BOLT TOP OF STONE BOUND 11.5 SOUTH OF AND 153' W. FROM S.E. COR. OF MILL FROM PLAN 2045 - BOUND IS SHOWN AS 60' UP STREAM FROM SPILLWAY PROP. PLAN - 8038	1873 BY SUPERIOR COURT DECREE VOL. 22 P. 127. WASHBURN MOEN MFG. CO. VERSUS CROMPTON CARPET CO. DEFENDANT	AMERICAN STEEL & WIRE CO.	
61-09 COES RESERVOIR		119		4229							NO AGREEMENT - COES CO.	
61-05 CURTIS POND	160	62	883	16663					ELEV. 473.51 TWO FEET BELOW BOLT IN EAST CONCRETE WALL OF SPILLWAY WORCESTER ELECTRIC LIGHT PLAN 1336 WATER RIGHTS PURCHASED 1917 FROM HILTON HEIRS BK 2123 PAGE 293 PROPERTY PLAN 8034 HIGH WATER MARK	JAN. 30, 1914 BY H.A. PRATT PRIV. ENG.	NEW ENG. POWER ASSOCIATES AM S & W CO. CAN OBTAIN WATER IN EMERG.	OLDEST WATER PRIVILEGE IN SYSTEM WORC. COUNTY ELEC. LIGHT CO. USES 2 MIL. GAL. 24 HRS (1921) FOR CONDENSING, POND KEPT FULL
03-03 HILTON POND	40	26.4	1347	6732	96.56	98.38	1939	GATE IS SCREW STEM 24" PIPE EARTH WITH CONCRETE CORE WALL PLAN FOR CORE WALL 5642 - CONCRETE SPILLWAY PLAN 13530 - 31 10591 REPAIRS			AMERICAN STEEL & WIRE CO.	
61-15 LEESVILLE POND	125		1522	15780							CONSOLIDATED RENDERING CO.	NECESSARY TO KEEP POND FULL FOR SUCTION OF THEIR PUMPS
03-05 MOSS RESERVOIR	256	158	699	699	110.79	112.17	1921 1928	CONCRETE EARTH ADDED CONCRETE GRAVITY SECTION COVERED WITH EARTH GATE SCREW STEM 30" x 30" BOX OUTLET	ELEV. 112.05 BRASS PLUG IN LEDGE EAST SIDE OF POND 208' SOUTH OF SPILLWAY CREST PLANS 14628 - SEE PLAN 8044 A FOR PARCELS PURCHASE - ALSO 8771 - 8777	OCT. 21, 1924 BY COUNTY COMM.	AMERICAN STEEL & WIRE CO.	DURING SUMMER MONTHS RESERVOIR LOSES 2' OF WATER WITHOUT DRAW DOWN
03-04 PONDVILLE POND	125	45	2639	4746				STONE MASONRY			LAREE FABRICS MILLS INC. WE HAVE NO AGREEMENT	USED FOR CLEANING & CONDENSING PURPOSES NO POWER USE
36-21 RAMSHORN POND	720	145	1527	1527	22.0	24.0	PREVIOUS TO 1831 1872-3	GATE SCREW STEM 24" & OUTLET PIPE (POSSIBLY) 30" EARTH PUDDLED TO EITHER SIDE CHESTNUT CUTOFF WALL ALONG DAM & (1873) PLAN 13515 A. B. B.	ELEV. 24.29' IRON PIN IN LEDGE ON WESTERLY SHORE ELEV. OF N.W. COR. OF N.W. BRIDGE WING WALL - 30.00	1872 REG. OF DEEDS, BK. 875, P. 132-149 PURCHASED BY A. CURTIS AS TRUSTEE FOR RAMSHORN POND CO. PREVIOUS TO RAISING DAM	RAMSHORN POND ASS. - A.S. & W. CO. WORC. COUNTY ELEC. HOPEVILLE MFG. CO. CONSOL. RENDERING CO. WHITTALL ASSOCIATES	MIN. FLOW REQ. BY SMALL MILLS WHEN IN OPERATION IS 6" THRU 26" WIDE WEIR 2,500,000 GAL. PER DAY FROM H.W. CLOVER FLOW FROM 1904 TO 1939 NEVER HAS EXCEEDED 10" OVER SPILLWAY USED FOR IMPONDED DURING RAINS & IN WINTER TO ENABLE CLOSING OF RAMSHORN POND GATE
36-21 RAMSHORN MEADOW POND	22	38	580	2107			1916	GATE 36" & OUTLET EARTH WITH CONCRETE CORE WALL, CONCRETE SPILLWAY PLAN 7171	PROPERTY MAP 8033		WHITTALL ASSOCIATES CALL ENG. RM FOR FLASH BR. CHANGE	USED FOR POWER WHEN PLENTY OF WATER OTHER USE IS FOR CLEANING
61-03 STILL WATER POND	35	30	605	24319				RACK PINON & CONCRETE	PROPERTY MAP 8769 (1904)		GUENSBURY COMBING CO. NEW ENGLAND POWER ASSOCIATES PURCHASED IN 1945	THE AGREEMENT IS THAT GUENSBURY COMBING CO. CAN DRAW SUFFICIENT WATER TO RUN PLANT WE CAN OBTAIN WATER BY CONSULTING N.E. POWER CO.
03-01 STONEVILLE POND		45	4870	7466					PROPERTY MAP 8769 (1904)		AMERICAN STEEL & WIRE CO.	DAM WASHED OUT
03-02 STONEVILLE RESERVOIR	185	68	1772	1772					FROM M. BONZEY 1917 BK. 2123, P. 290		AMERICAN STEEL & WIRE CO.	
03-07 SOUTHGATE POND	1.5	1.5	83	782				GATE EARTH & STONE WALL 30" & OUTLET			AMERICAN STEEL & WIRE CO.	
61-01 SOUTH WORKS POND	20.0	130	381	24700	438.04	440.04	1891	FLOOD GATE - RACK & PINION, INTAKE GATE - SCREW STEM INSTALLED IN 1943 - MASONRY PLAN 3955 INTAKE 14454 A-H SECTIONS THU. POND 3265 (1906) 12792 (1936)	ELEV. 443.47 SAME AS CENTRAL WORKS) ESTABLISHED IN EXCHANGE OF TITLES BETWEEN HOLY CROSS, AM. S. & W. CO. CITY OF WORCESTER AND P.F. & F.W. TAYLOR PROP. PLAN 8041	AP. 29, 1909 BK. 1904, P. 68 THIS IS (TAYLOR DEED)	AMERICAN STEEL & WIRE CO.	18,700,000 GAL. PER DAY REG. FOR SOUTH WORKS & WIRE MILL AS MEASURED IN 1942 PREPARATORY TO INTAKE CHANGES

\* RUN OFF FROM WATERSHED EFFECTED BY CITY STREETS AND STORM SEWERS  
PLANS FOR MOSS RES. DAM: CONCRETE, ORIGINAL DAM 8510 TO 12, PRES. CONST. 10584, 10582-3, 10507 & 510400, 514628  
PROPERTY, 1877, 8044A & LOTS PURCHASED IN CEDAR SWAMP 8771  
NOTE: THE INFORMATION SHOWN ON THIS PLAN WAS DRAWN EXISTING PLANS, & FROM FILES OF SUPT. OF ENG. & MAINT.  
PARTICULARLY THE G.E. GOODRICH REPORT NOV. 14, 1921 AND "MOSS RESERVOIR" DATA CONCERNING ORIGINAL OWNERS OF CEDAR SWAMP

THIS DRAWING AND ALL INFORMATION THEREON IS THE PROPERTY OF THE AMERICAN STEEL & WIRE COMPANY AND IS CONFIDENTIAL AND MUST NOT BE MADE PUBLIC OR COPIED UNLESS AUTHORIZED BY THEM AND IS SUBJECT TO RETURN UPON DEMAND.

WATER SHED OF  
SOUTHWORKS POND

DAM NOS. AS NOTED IN PLAN

WATERSHED PLAN  
FIGURE D-1



APPENDIX E  
INVENTORY FORMS